Declaration Management:
Status & Proposed Experiments

Presented to:

AMG-11

24 April 1996

Background

- A Major Goal of HLA is to Support Large Scale Distributed Simulations

- Key Approach to Scalability is to Conserve Communications & Processing Resources by Sending Data Only When & Where it is Needed

- RTI Uses Filters & Routing Mechanisms to Deliver Data between, & only between, the Publishing & Subscribing Federates

- A Series of Experiments will Assist the Design & Implementation of RTI Filters & Routing Mechanisms

Recent Activity

- **Meetings, Teleconfs, Email between Data Schleppers**

- **Revised IF Spec to Agree with Static Class/ Attribute Filtering Needed to Support Proto- federations (Approved by AMG-9)**

- **Changes Reflected in Current Version of IF Spec Available on DMSO Home Page**

- **Joint Meeting with Time Management to Discuss Filtering Issues in Event Driven Simulations**

Real Time Sim Filtering Experiments

- Experiments will be Based on Implementation of LL "Filter Space" Approach in the RTI

- STOW "Category" Approach will be Implemented in Federate Space but Will Use the Filter Space Services of the RTI.

- Special Version of RTI with Filter Space Capability will be Used to Support Experiments

- Experiments will be Conducted at Integration & Evaluation Center (IEC) of Army's Topographic Engineering Center at Ft Belvoir by JPSD Personnel

Category Filter Approach

- **Federations Define a Series of Categories & Associate a Number with Each**
- **Categories can Represent Any Combination of Class/Attribute Values (e.g., all tanks in sector A)**
- **Federates Subscribe to Categories (e.g., tell me location of all land vehicles with category = 23)**
- **Publishing Federate Includes Category # in Attribute Update**
- **RTI Uses Category Info to Set Up Comm Channels**

Filter Space Approach

- **Federations Identify Attributes (in FOM) that can be Combined into Multi-Dimensional Filter Spaces**

- **At Run Time Federates Create Filter Spaces with Min/Max Values for Each Dimension**

- **Federates Subscribe to Filter Spaces (e.g., tell me location of all land vehicles in created filter space)**

- **Publishing Federate Associates Attribute Update with Filter Space**

- **RTI Sets Up Comm Channels for Overlapping Subscribe & Publish Filter Spaces**

IEC & JPSD Capabilities

- Large Number (40+) of High performance Sun & SGI Workstations

- Several LANs (Ethernet, FDDI, ATM) & High Speed WAN Connections

- Data Loggers, Defined Measurement Points, & Analysis Software

- Recent Experience with Large Scale (8300 entity peak) DIS Exercises as Part of JPSD Program

- Led by Russ Richardson of SAIC

- Working with Paul Reynolds & Sudhir Srinivasan to use their HLA Performance Measurement Framework

Extensions to IF Spec

- **Modified & New Sections have been Drafted to Support Experiments.**

- **Modified Section/Services:**
  - **Subscribe Object Class**
  - **Subscribe Interaction Class**
  - **Send Interaction**

- **New Section/Services:**
  - **Filter Control (Create, Modify, Delete)**
  - **Associate Filter Specification**
  - **Provide Thresholds**
  - **Subscribe Object Instance**

- **Will be Incorporated into Baseline IF Spec Pending Results of Filter Experiments**

Experiment Goals

- **General**
  - Learn & Understand as much as Possible About RTI Behavior Under Various Filtering Approaches & Algorithms
- **Functionality**
  - Do we have all the Functionality that we need?
  - Is the Functionality Located at the Appropriate Places in the Structure?
- **Performance**
  - Understand Latency Effects
    - » Additional Latency on Attribute Updates & Interactions
    - » Latency Involved in Instantiating a New Filter (subscription)
  - Throughput & Communications Efficiency
  - Additional Processing Requirements
  - Ease of Use
    - » Determine Degree to which RTI API Facilitates or Restricts the Implementation & Efficiency of Alternative Filtering Approaches

Independent Variables

- **Number of Federates**

- **Objects Simulated per Federate**

- **Number of Remote Objects that Interact with each Local Object**

- **Average Attribute Update Rate per Object**

- **Mapping of Objects to Federates (i.e., the correlation between their physical locations on the network and their interactions in the virtual world)**

Experiment Sequence

- **Create Baseline Case with no Filtering**
- **Use Filter Space Approach**
- **Use Application Generated Category Approach**

Scenarios

- **Militarily Realistic Scenarios**
    - **Begin with Large, Force-on-Force Land Battle Scenario**
        - » **Expand in Breadth (number of combat units "on line")**
        - » **Expand in Depth (rear echelon units, support trains, etc.)**
    - **Add Fast Movers**
    - **Add Wide-Area Sensors**

- **Artificial Scenarios (e.g., objects arranged in known patterns) may be used to Probe Certain Issues**

Filtering & TM in Event Driven Sims

- **Intimate Relationship -- Can Not be Treated Same as Filtering in Real Time Sim**
- **Issues Being Explored in Separate Effort Led by Jeff Steinman of Metron**
  - Initial Experiments & Recommendations Expected at End of CY96
  - Related Effort will Produce Document on Declaration Management Similar in Scope to HLA TM Document

Schedule

- **Mid-May -- Test Special Version of RTI to Support Filter Experiments**

- **1 June -- Start IEC Filter Experiments**

- **26 June -- Initial Feedback to IF Spec**

- **31 July -- Final Feedback to IF Spec**

- **31 Dec -- Complete Initial Experiments & Recommendations for Event Driven Filter Experiments**